(12) UK Patent Application (19) GB (11) 2 396 335 (13) A

(43) Date of A Publication 23.06.2004

(21) Application No: 0229907.1

(22) Date of Filing: 21.12.2002

(71) Applicant(s):
Dominic Michaelis
624 Batterie Basse, Cap Brun 83000, TOULON, France

Gilles Bouchez
66 Rue Rene Boulanger, PARIS 75010, France

(72) Inventor(s):
Dominic Michaelis
Gilles Bouchez

(74) Agent and/or Address for Service:
Michaelis Boyd Architects
90A Notting Hill Gate, LONDON, W11 3HP, United Kingdom

(51) INT CL[7]:
B63C 7/00 , E02B 15/04

(52) UK CL (Edition W):
B7A AAMQ

(56) Documents Cited:
GB 1594117 A
WO 1993/011305 A1
FR 002463835 A
US 4047390 A
WO 2000/058564 A1
FR 002804935 A
FR 002368581 A

(58) Field of Search:
UK CL (Edition V) **B7A**
INT CL[7] **B63C, E02B**
Other: **Online EPODOC JAPIO WPI**

(54) Abstract Title: **Flexible shipwreck cover**

(57) A shipwreck cover is made of a flexible material and is lowered over a shipwreck site to contain contaminants 15 leaking from the wrecked ship 11 to prevent environmental pollution. The cover may be formed from a membrane 1 stretched over a tubular network 2, 3, 4 and 5 which is made rigid by hydraulic pressure such that the cover forms a bell or dome shape. The cover may be provided with a pressurised tube 6 that surrounds its base from which a weighted skirt 7 hangs to seal against the seabed. The cover may be fixed in place using cables 9 attached to seabed weights 10 then released and winched back to the surface when salvage operations are complete. Alternatively the cover may be inflated on a beach or quay-side and drawn by tugs to the shipwreck site before being lowered over the wreck.

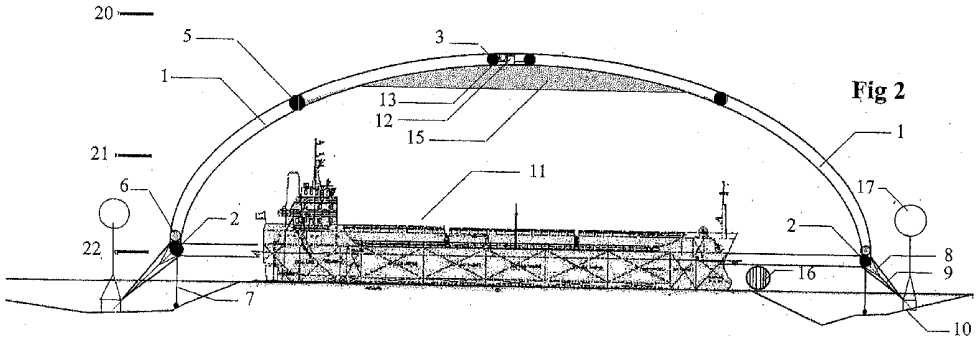

Fig 2

GB 2 396 335 A

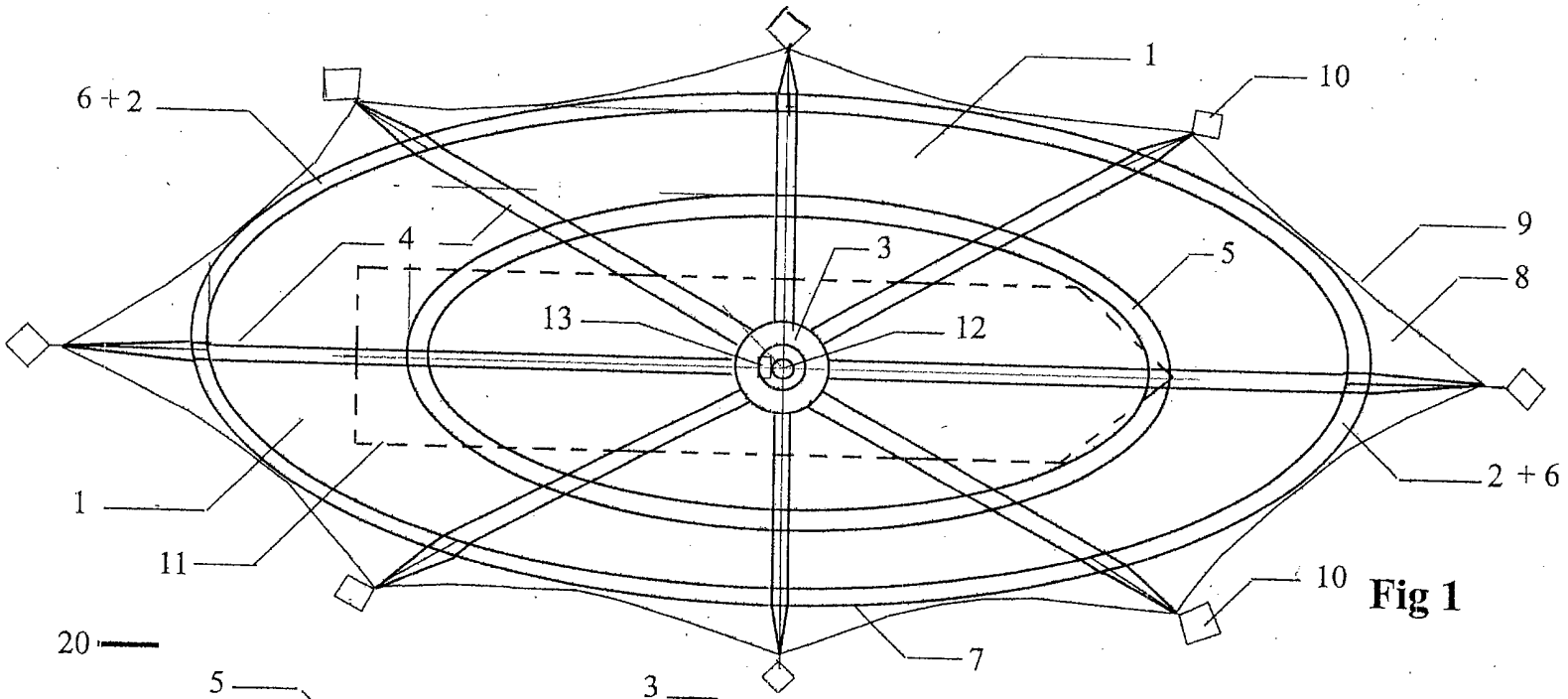
6 + 2
1
10
9
8
4
3
5
13
12
1
11
2 + 6
10
7
20

Fig 1

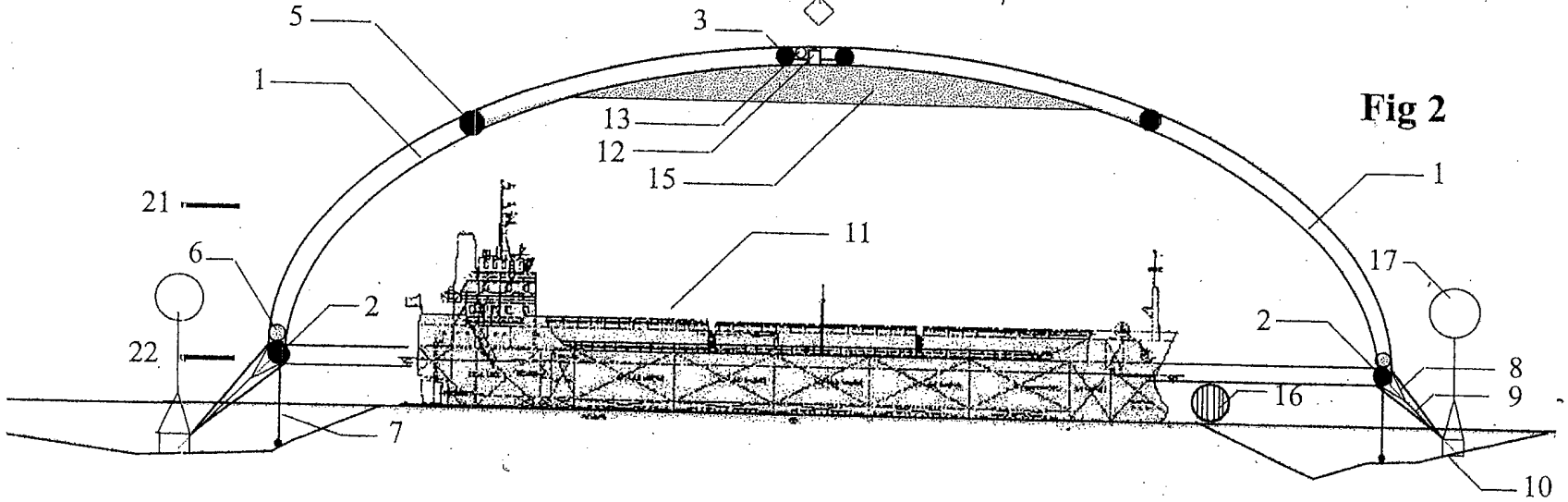
5
3
1
13
12
15
1
21
11
6
17
2
2
22
8
9
16
7
10

Fig 2

SHIPWRECK COVER

This invention relates to shipwreck covers.

It occurs frequently that ships carrying dangerous cargo, whether liquid, solid or gaseous, sink or run aground, and spill their cargo into the sea, which then carries it to nearby beaches where it can cause pollution and danger to local inhabitants and to wildlife. Oil spills have all too often resulted from oil tankers sinking, and buffeted by the seas, being badly damaged so that oil, generally lighter than water, is released from their gutted tanks, and causes environmental calamities.

According to the present invention, there is provided a shipwreck cover, made of flexible or other materials, that can be brought to the shipwreck site, and gradually lowered over the sunken ship, so that all spillages from the wreck, whether liquid, gaseous or solid can be contained, thus causing no environmental pollution.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows a plan view of the cover over the sunken vessel.
Figure 2 shows a diagrammatic section through the deployed cover over the shipwreck.

Referring to Figures 1 and 2, there is provided a shipwreck cover ,which, in its folded form, can be packed compactly, and is designed as a dome like structure, the form and rigidity of which is given by a membrane 1 and pressurised tubular members, these being generally filled with water under hydraulic pressure, where the cover is being used to protect an underwater wreck, or air, where the structure is erected principally above the water line, or by both where the structure is partially immersed. The cover can rapidly be brought to the disaster scene, and in the more general case of a sunken vessel, can be deployed on the surface by a number of tugs, and allowed by winches to sink to a predetermined depth at which the tubes are pressurised with water, one secondary circumferential tube 2 being filled with air by a pump and a liquid air supply to keep its shape as the depth increases, to insure the bouyancy of the whole rigidised structure which can then be gradually lowered over the wreck, being light and easy to manoeuvre by small prehensile submarines. The cover is fitted with a skirt 7 provided at its base with a chain or heavier than water ballast that takes up the floor irregularities so acting as anchor to the overall structure which covers the wreck, any spills from which are so contained.. A number of buoyed weights 10 can also be released by a submarine in predetermined positions to further anchor down the structure if necessary.

Referring to Figure 1, there is shown a plan view illustrating the principal membrane 1 stretched between the tubular structural elements, one forming the lower outer end boundary structure, 2, and another forming the crown, 3, from which depart radial tubular elements, 4, stabilised by an intermediary circumferential tube, 5. Above the outer structure,2, is a

superimposed circumferential tube,6, filled with compressed air which insures the buoyancy of the whole structure, and in particular compensates for the weighted skirt 7 below the outer structure 2 .

Figure 1 also illustrates the optional outer tensed membrane 8, stretched between cables 9, and the principal membrane, these cables being attached to weights 10 to locate the cover over the shipwreck ship 11 or leaking fragments thereof.

The crown ring 3 acts as housing for an upper valve 12, through which any lighter than water fluid can be pumped, and for pumps and pressurising devices 13, necessary for the rigidising of the structure. It can also contain the liquified air supply necessary for the buoyancy ring 6.

Referring to figure 2, an underwater section is taken through the cover showing the membrane 1 stretched between the pressurised tubes 2,3 4, and 5, which give shape and rigidity to the overall structure. The whole structure is held down by the weighted skirt 7 which adapts to the contours of the ocean bed. Additionally, the section shows the weights 10 lightened by buoys 17 for manoeuvreability during installation, but freed afterwards, attached to cables 9 and outer tensed membrane 8, providing optional firmer location to the overall structure.

Figure 2 also shows the crown tubular section 3 acting as support for the central valve 12 through which oil or other lighter than water fluids can be recovered, having formed a pocket 15 below the crown of the cover, which houses also pumps and pressurising equipment 13, and liquified air required for the buoyancy tube 6 running above the circumferential tube 2 .

Cables from the sea surface would connect to the crown, which would be designed to be serviced by "prehensile" mini-submarines. A hatch 16 is provided in the skirt 7 to allow for the passage of divers or mini-submarines that may need to access the wreck.

In this arrangement, the tubular structure is not exposed to the spilt substance, and only the membrane itself 1 and the skirt 7 need to be treated on the inside to be resistant to possible chemical attack.

The cover can be used when the ship or part of the ship is either completely underwater 20, or in low waters when the water level is between the crown and the base 21, or even when the ship is floating, but leaking liquid or gaseous chemicals that need to be contained 22.

Because the tubular members and the membranes can be folded, much as a hot air balloon, the shipwreck cover can be compactly folded and stored on board specialised ships that can rapidly intervene when a carrier ship is in difficulty.

As the cover is unfolded, air is trapped between the weighted skirt and the membrane, insuring that it can be unfolded and spread out, without sinking, before the base tube 2 is filled and pressurised, the whole then gradually sinking, witheld by winches, the air being released by the remotely controlled valve 12. After salvage operations are completed, and pollution risks removed, the cover can be released and winched back to the surface, where it can be repaired as necessary, cleaned, and packed ready for further use.

In an alternative preparation, the structure can be deployed on a beach or quayside, the base tube 2 being inflated with air first, and the rest of the tubular network thereafter, the skirt and outer membrane hitched up above the base tube, the base tube anchored down to resist any wind pressure. The inflated structure can then be pulled onto the sea surface, some water being allowed into the base tube 2 to give it weight against the wind overturning it. It can then be towed in its air inflated form to the shipwreck site, and as the air is gradually replaced by water under hyraulic pressure, it will immerse itself, and held in place by tugs, be lowered over the disaster site, and positioned by small prehensile submarines.

In a variant of this method of deployment, a small jet engine can be temporarily fixed to the crown, pressurising the air inside the dome, so that it hovers over the sea surface and can be moved with greater ease. The engine can be released by remote control clamps and be taken away by helicopter before total immersion.

The pollution barrier that the shipwreck cover affords can be invaluable, and its cost is a negligeable amount compared to the immense cost of clean up operations.

CLAIMS

1 A shipwreck cover made of flexible or other materials, that can be brought to the shipwreck site, and gradually lowered over the sunken ship, so that all spillages from the wreck, whether liquid, gaseous or solid can be contained, thus causing no environmental pollution.

2 A shipwreck cover as described in Claim 1 that is made of flexible materials, principally a membrane held in place by a tubular network, the network being rigidised by hydraulic pressure established within its various members, the whole taking on the overall shape of a bell-like concave generally elliptical or circular dome.

3 A shipwreck cover as described in Claims 1 and 2, which can be lowered over the shipwreck, so as to capture any lighter than water spillages that float to its crown, also containing gaseous emissions.

4 A shipwreck cover , as described in Claims 1, 2, and 3, which is provided with a base circumferential pressurised tube, from which hangs a adjustable skirt, weighted at its bottom end, such that it can adapt to the level differences of the sea bed surrounding the stricken ship, the said tube being linked to a secondary tube filled with pressurised air, insuring the buoyancy of the overall structure.

5 A shipwreck cover, as described in claims 2 and 3, which is fitted at its crown with a large diameter valve through which air can be released during its installation, and later, any lighter than water spillage can be pumped away to a surface recovery craft.

6 A shipwreck cover fitted with an outer edge membrane and cables that can be secured to carefully located weights, initially fitted with metal buoys capable of resisting deep water pressures, and released when the weights are lowered into position.

7 A shipwreck cover, as described in claim 4, which is provided at its base with an opening hatch to allow the visit of divers or mini-submarines depending on the seabed depth, for inspection, maintenance, and eventual removal of certain elements.

8 A shipwreck cover as claimed in claims 1, 2 and 3, which being made of flexible materials, can be compactly packed on board a specialist vessel, and rapidly brought to the disaster site.

9 A shipwreck cover, as claimed in claim 8, that can be deployed on the sea surface, a number of air pockets preventing it from sinking, the tubes being then gradually pumped full of water under pressure, the whole structure then slowly sinking, witheld by tug winches, the trapped air being released by the temporarily opened crown valve.

10 A shipwreck cover as claimed in claims 8 and 9 which is lowered by winches and guided by mini-submarines to take its position over the sunken vessel or parts thereof, held in position by its weighted skirt, and optionally further secured to an array of weights.

11 A shipwreck cover , as claimed in claims 1,2 and 3, in which the tubular structure is designed to withstand sea water exposure, and only the inside of the internal membrane and the skirt need to be coated with material able to withstand any potentially corrosive conditions.

12 A shipwreck cover which, after salvage operations are completed, and pollution risks removed, can be released and winched back to the surface, where it can be repaired as necessary, cleaned, and packed ready for further use.

13 A shipwreck cover which can be inflated on a beach or quayside, and drawn by tugs to the disaster site to be there lowered over the wreck.

14 A shipwreck cover, as claimed in claim 13, which can be fitted temporarily with a small removeable jet engine mounted in its crown, so that positive pressure is established under the dome, and the whole structure hovers over the sea surface, so as to be moved more easily and rapidly.

15 A shipwreck cover substantially as described herein with reference to Figures 1-2 of the accompanying drawings.

INVESTOR IN PEOPLE

Application No:	GB 0229907.1	**Examiner:**	Richard Collins
Claims searched:	1 to 5 & 7 to 11	**Date of search:**	23 January 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1-3,5,8,11	US 4047390 A	(BOYCE) see figure 1
X	1,3,5,8	GB1594117 A	(COFLEXIP) see figures 1 and 2.
X	1,3,5,8	WO 00/58564 A1	(GRINDE) see figure 1.
X	1,3,5,8	WO 93/11305 A1	(SETERNES) see figure 1.
X	1,3,5,8	FR 2804935 A	(CHENIN) see figures 1 to 3.
X	1,3,5,8	FR 2463835 A	(CHASTANBA) see figure 1.
X	1,3,5,8	FR 2368581 A	(KERUZORE) see figure 2.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

B7A.

Worldwide search of patent documents classified in the following areas of the IPC[7]:

B63C; E02B.

The following online and other databases have been used in the preparation of this search report:

Online EPODOC, JAPIO, WPI.